University of Northern Iowa

UNI ScholarWorks

Summer Undergraduate Research Program (SURP) Symposium

2021 Summer Undergraduate Research Program (SURP) Symposium

Jul 30th, 11:30 AM - 1:15 PM

Comparison of expiring CP-25 and 3-year old CP-42 plantings for monarch habitat quality

Schuyler Hop
University of Northern Iowa

Laura L. Jackson Ph.D.
University of Northern Iowa

Let us know how access to this document benefits you

Copyright ©2021 Schuyler Hop and Laura L. Jackson

Follow this and additional works at: https://scholarworks.uni.edu/surp

Recommended Citation

Hop, Schuyler and Jackson, Laura L. Ph.D., "Comparison of expiring CP-25 and 3-year old CP-42 plantings for monarch habitat quality" (2021). *Summer Undergraduate Research Program (SURP) Symposium*. 12.
https://scholarworks.uni.edu/surp/2021/all/12

This Open Access Poster Presentation is brought to you for free and open access by the CHAS Conferences/Events at UNI ScholarWorks. It has been accepted for inclusion in Summer Undergraduate Research Program (SURP) Symposium by an authorized administrator of UNI ScholarWorks. For more information, please contact scholarworks@uni.edu.

Comparison of expiring CP-25 and 3-year old CP-42 plantings for monarch habitat quality

University of Northern Iowa
Biology

July 31st, 2021

Schuyler Hop with Gretchen Steffensmeier, Pryce Johnson, Tristan Murphy and Dr. Laura Jackson
Tallgrass Prairie Center and Department of Biology, University of Northern Iowa

Tallgrass Prairie Center
UNIVERSITY OF NORTHERN IOWA
Restoring a National Treasure

Background

- Tallgrass prairie once covered greater than 80% of Iowa land, but widespread industrialization and land conversion have resulted in less than 0.1% of our native prairie remaining. [1]
- The Conservation Reserve Program (CRP) is a voluntary program administered by the United States Department of Agriculture's Farm Service Agency (FSA). Landowners convert agricultural land to restored prairie. These prairies are valuable because it controls soil erosion, develops wildlife habitat, and improves water quality. [2]
- The CP-25 program emphasizes the restoration of rare and declining native plants and wildlife species. Participants of this program are contracted for 10-15 years, with a goal of increasing the diversity of native plant communities. However, no formal methods to evaluate CP-25 site quality exist. The CP-42 program emphasizes native habitat development for pollinators including bees, butterflies, and bats. These species are important to our agricultural systems. [3]
- Habitat loss, climate change, and increases in herbicide have contributed to a drastic loss in the monarch butterfly population. Monarch butterflies require milkweed (*Asclepias* species) to lay eggs on and provide food for larvae. Adults contribute to important pollination of a wide range of wildflowers. The decline of the monarch is a signal of the stress that all pollinators are confronting. [4]

Figure 1 (left) An example of the quadrat used for vegetation surveys

Methods

We surveyed plant communities at 16 expiring CRP plantings, located in a 70-mile radius of Cedar Falls, Iowa. All sites were CP-25 and visited during June and July of 2021. The age of all sites were over 10 years. The size of sites ranged from 2.1 to 96.1 acres with mean of 32.4 acres and median 30.8 acres. Landowner and manager participants were chosen from the FSA list of expiring CRP contracts, with the team tasked with contacting and interacting with landowners before and during site visits.

CP-25 Vegetation Surveys: Teams surveyed 100 1 m² quadrats (0.5 m x 2.0 m) placed 5 m apart along a series of parallel transects during each site visit. The number of transects varied depending on site dimensions and size, with randomly selected points obtained using Geographic Information Systems software (ESRI, 2020). Orientation of the parallel transects was obtained through selection of randomly selected number from 0 to 359. Even numbered transects were then given the opposite orientation (x + 180°) to provide more complete coverage of sites. Points were uploaded from the GIS software onto a Garmin Oregon 750t GPS, which were then taken to the site to find the starting point of each transect.

At the site, each 1 m² quadrat was divided into 3 sections; the first quadrat began at the 0-meter mark of the transect with the first 2 sections (A & B) on the left side of the transect line. Figure 1 shows the quadrat sections as follows: section A was 0.25 m², section B was 0.25 m², and section C on the right side of the transect line was 0.5 m² [5]. Species presence were recorded in sections A & B; species that were present in section A were not recorded again in section B. In section C, any new species that were present were recorded. Milkweed stems within our quadrats and separated by soil were recorded as distinct plants, regardless of whether they were clonal or genetic individuals.

CP-42 Floral Survey: Field methods for the 2019, CP-42 study can be found in "Effects of seed mix and surrounding land cover on Asclepias syriaca density in the Conservation Reserve Program's Pollinator Habitat plantings" by Kate Sinnott [6].

Research Questions

- How does milkweed density compare between CP-25 and CP-42?
- Is there a difference in nectar plant frequencies by flowering time?
- How do nectar plant frequencies compare between CP-25 and CP-42?

Figure 2: The team examining a quadrat.

Results

Asclepias syriaca (common milkweed) was the most abundant milkweed observed in both the CP-25 and CP-42 fields, with values of 79.3% and 67.2% of all milkweed found, respectively. *Asclepias verticillata* was present in both, with CP-25 at 20.7% of all their milkweed and CP-42 at 12.5%. *Asclepias tuberosa* (20.3%) was only present in the 3-year-old CP-42 plantings. When comparing stem density, Figure 3 shows that the expiring CP-25 fields contained slightly more stems per square meter (0.263 stems/m², SE=0.061) than the CP-42 fields (0.247 stems/m², SE=0.104).

A list was compiled for early, middle, and late flowering plants that adult monarchs use for nectar sources [7]. Data collection from CP-25 and CP-42 were analyzed for frequency of any nectar source in quadrats. Figure 4 is a comparison of nectar frequency between the two field types. Figures 5 & 6 are the distributions of nectar sources, separated by flowering time and field type. A t-test was performed to identify statistical significance ($\alpha = 0.05$) of flowering times. Table 1 shows the p-values.

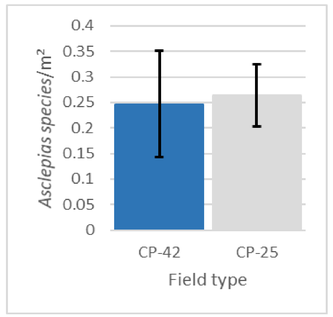

Figure 3: Average milkweed stem density by field type

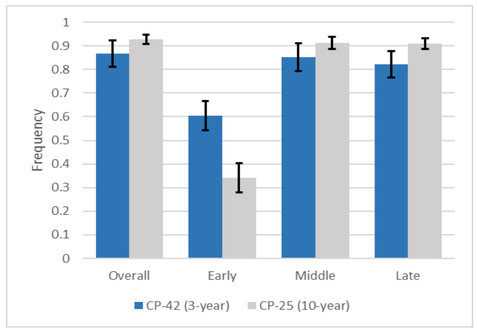

Figure 4: Average Nectar Frequency by Flowering Time

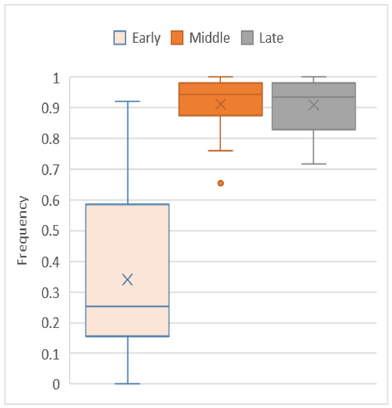

Figure 5: Distribution of Monarch Nectar plant Frequency by Flowering Time, CP-25

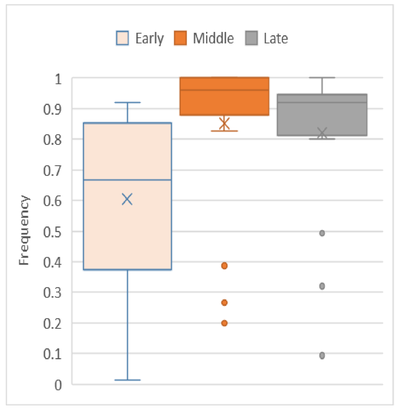

Figure 6: Distribution of Monarch Nectar plant Frequency by Flowering Time, CP-42

CP-25	p-value		CP-42	p-value		CP-25 v CP-42	p-value
Early v Middle	4.90E-08		Early v Middle	0.007		Early v Early	0.005
Early v Late	5.58E-08		Early v Late	0.007		Middle v Middle	0.356
Middle v Late	0.95		Middle v Late	0.715		Late v Late	0.163

Table 1: Student's t-test for significance of CP-25 and CP-42 flowering times

Figure 7 (from L to R) Pryce Johnson (front), Tristan Murphy, Dennis Jennings (landowner), Schuyler Hop, Gretchen Steffensmeier

Conclusions

- *Asclepias* species density is not significantly higher in 3-year-old CP-42 fields than expiring CP-25 fields. CP-42 seed mix contained *Asclepias* species while CP-25 did not.
- There is no significant correlation between overall nectar frequency and *Asclepias* species density.
- There is strong to overwhelming evidence that early nectar frequency is significantly lower than middle and late nectar frequency for both CP-25 and CP-42.
- There is strong evidence that early nectar frequency in expiring CP-25 fields is significantly lower than early nectar frequency in 3-year-old CP-42 fields. CP-42 has a higher monarch habitat quality early in the season.
- More data is needed to further the understanding and impacts of both CP-25 and CP-42 on monarch habitat quality and survivability.

Figure 8: *Monarda fistulosa* (beebalm), a middle and late season forb

Figure 9: *Asclepias syriaca* a host plant for monarch caterpillars

Acknowledgements

Thank you to the staff of the Tallgrass Prairie Center, especially Aaron Sanderson, Justin Meissen, and Laura Walter for assistance with plant identification and method design. Thank you to the Iowa landowners for allowing us to survey their land. Special thanks to UNI's Summer Undergraduate Research Program, Dr. Gary Floyd, and Mrs. Floyd for funding this research.

References

[1] Smith, Daryl D. (1998) "Iowa Prairie: Original Extent and Loss, Preservation and Recovery Attempts," *Journal of the Iowa Academy of Science: JIAS, 105(3)*, 94-108. Available at: https://scholarworks.uni.edu/jias/vol105/iss3/4
[2] *Conservation reserve program.* (n.d.). [Page]. National-Content. Retrieved July 22, 2021, from https://fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index
[3] Crp mixes. (2017, January 21). *Shooting Star Native Seeds.* https://www.shootingstarnativeseed.com/seed/seed-mixes/crp-mixes/
[4] *Pollinators—Monarch butterfly (U. S. National park service).* (n.d.). Retrieved July 22, 2021, from https://www.nps.gov/articles/monarch-butterfly.htm
[5] Cariveau, A. B., Holt, H. L., Ward, J. P., Lukens, L., Kasten, K., Thieme, J., ... & Oberhauser, K. (2019). The integrated monarch monitoring program: from design to implementation. *Frontiers in Ecology and Evolution*, *7*, 167. https://doi.org/10.3389/fevo.2019.00167
[6] Sinnott, Kate; Simpson, Emma; Madsen, Kathleen; and Jackson, Laura, "Effects of seed mix and surrounding land cover on Asclepias syriaca density in the Conservation Reserve Program's Pollinator Habitat plantings" (2019). *Summer Undergraduate Research Program (SURP).* 6. https://scholarworks.uni.edu/surp/2019/all/6
[7] Wild Ones (n.d.). *Wild for monarchs.* wildones.org. https://monarchjointventure.org/images/uploads/documents/wfm_brochure_final.pdf